The new Danish Salmonella surveillance on fresh pig carcasses based on pooled swab samples including compatibility with levels of the former system

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Summary: The nation-wide surveillance of Salmonella in Danish pork has been revised by the 1st of January 2001 and is now based upon swabs from fresh chilled pork carcasses instead of cuts. At each slaughterhouse 5 carcasses are sampled randomly every day and analysed as one pooled sample. The results are evaluated by looking at the results from the last 11 slaughter days. For the first 5 month of the year the prevalence of Salmonella on individual fresh pig carcasses has been 1.7%.

A study was carried out to show the compatibility to the former surveillance system. Throughout year 2000 5 daily swaps at 8 slaughterhouses were individually analysed whereas 5 other daily swaps from other carcasses were pooled before analysis. Based on these data a 40 % drop in sensitivity was indicated.

Keywords: sensitivity, prevalence.

Introduction: In Denmark the nation-wide surveillance of Salmonella in pork has been revised by the 1st of January 2001. Now samples are taken from fresh chilled pig carcasses instead of cuts. The sampling method is equivalent to the one described by USDA for slaughterhouses exporting to the USA.

To show the compatibility between the new and the former surveillance, a study was carried out at 8 slaughterhouses during the year 2000.

Materials and Methods:
At each slaughterhouse, five randomly selected carcasses per slaughter day are swabbed at three defined areas (the hind leg near the tail, the sternum and the jowl) at 100 cm² for each area. The three areas are swabbed with the same gauze tampon, and the gauze tampons from the five carcasses sampled on the same day are analysed as one pooled sample.
The results are evaluated by looking at the results from the last 11 slaughter days. In this period one positive sample is allowed. If a second positive sample is found, the limit is exceeded and actions must be taken. Every situation is individually evaluated, including the serological salmonella-status of the tested herds and the results of the critical control points for hygiene (i.e. coli samples, faecal contamination). If there is a probable cause for exceeding the limit corrective actions are implemented, otherwise the sampling is intensified. The routine surveillance is maintained during the intensified sampling period.

The slaughterhouses are responsible for selection of the carcasses, for sampling, analysing and reporting the results to the Regional Veterinary Authorities. In case of extension of the limits the follow-up has to be described by the slaughterhouse and approved by the Official Veterinarian.

The evaluation of the salmonella-prevalence when the surveillance is changed, must in particular take account of two points:

- Pooling 5 swaps at a time has obvious advantages from a practical and economical viewpoint, but is it justifiable if sensitivity drops heavily? Throughout year 2000 five daily swaps at 8 major slaughterhouses were individually analysed whereas 5 other daily swaps (from other carcasses) were pooled before analysis.
- moving the measurements up the assembly-line from cuts to carcasses changes the risk and nature of Salmonella-contamination. Data to shed light on this has been collected for more than a year at the 8 mentioned slaughterhouses throughout Denmark, based on 5 daily swap samples (per plant), individually analysed, as well as monthly (per plant) results on cuts. Based on this, a conversion ‘from cut to swap’ can be defined.

Using simple logistic and Poisson regression techniques (e.g. Armitage 1994), the information from these two sources could be combined to define the target-prevalence of the 5-swap-pool surveillance system, in a way that would correspond to the original goal as defined in terms of salmonella prevalence in cuts.

**Results:** For the first 5 month of the year 2001 the prevalence of Salmonella on individual fresh pig carcasses has been 1.7%.

In total 9066 single- and 1795 5-pool-swaps were collected from 8 major slaughterhouses in Denmark throughout year 2000. The overall prevalence was 1.5% in single swaps and 4.0% in pooled swaps. Theoretically, the pool prevalence should be 5 times larger, since the probability of at least one positive sample among 5 independent samples from the same population, should be very close to 5 times larger than the population prevalence, at least for small prevalences. After
correction for differences in slaughterhouse prevalence and timetrends, a conversion factor of 2.9 (95% CI 2.2-4.0) was found. The connection between monthly prevalence in 3 selected groups of cuts (former surveillance) and 5 daily single swaps in fresh meat is of course somewhat weaker. Based on an assumption of a common 'correction'-factor, this can be estimated from these data as 1.9 (95% CI 1.5-2.4).

**Discussion:** The advantage of sampling carcasses instead of cuts is that each carcass is tattooed with a herd specific number, which makes it possible to trace each sample back to the herd of origin. The surveillance is targeted towards the monitoring of Salmonella-prevalence in pork nationwide, not on the individual slaughterhouse, where only yearly prevalence estimates make sense. The 9066 single swap results allowed assessment of the independence assumption behind the use of pooled swab estimates of prevalence. According to this assumption each day’s 5 single swabs should be independent trials with the same probability of Salmonella leading to a binomial distribution. A formal test of independence could then be performed. The result seemed in accordance with the independence assumption.

**References**